

# INTELLIGENT ROBUST CONTROL SYSTEM FOR MOTORCYCLE USING SOFT COMPUTING OPTIMIZER

## Abstract

5           A Soft Computing (SC) optimizer for designing a Knowledge Base (KB) to be used in  
a control system for controlling a motorcycle is described. In one embodiment, a simulation  
model of the motorcycle and rider control is used. In one embodiment, the simulation model  
includes a feedforward rider model. The SC optimizer includes a fuzzy inference engine based  
on a Fuzzy Neural Network (FNN). The SC Optimizer provides Fuzzy Inference System (FIS)  
10 structure selection, FIS structure optimization method selection, and teaching signal selection  
and generation. The user selects a fuzzy model, including one or more of: the number of input  
and/or output variables; the type of fuzzy inference; and the preliminary type of membership  
functions. A Genetic Algorithm (GA) is used to optimize linguistic variable parameters and  
the input-output training patterns. A GA is also used to optimize the rule base, using the fuzzy  
15 model, optimal linguistic variable parameters, and a teaching signal. The GA produces a near-  
optimal FNN. The near-optimal FNN can be improved using classical derivative-based  
optimization procedures. The FIS structure found by the GA is optimized with a fitness  
function based on a response of the actual plant model of the controlled plant. The SC  
optimizer produces a robust KB that is typically smaller than the KB produced by prior art  
20 methods.

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